CLAIMS

What is claimed is:

1. A network interface card for a data storage system having a backplane and processing circuitry for performing block-based data access operations, the processing circuitry of the data storage system being physically connected to the backplane of the data storage system, the network interface card comprising:

a first port that is capable of coupling to an external network;

a second port that is capable of physically connecting to the backplane of the data storage system; and

control circuitry interconnected between the first port and the second port, the control circuitry being configured to, when the first port couples to the external network and the second port physically connects to the backplane of the data storage system:

(i) receive file-based communications from the external network through the first port and provide block-based communications to the processing circuitry of the data storage system through the second port and the backplane in response to the file-based communications,

(ii) receive block-based communications from the processing circuitry through the second port and the backplane and provide file-based communications to the external network through the first port in response to the block-based communications, and

(iii) provide application server resources to operate as an application server that runs application-level programs.

2. The network interface card of claim 1 wherein the control circuitry includes a section of circuit board material and a processor which is physically mounted to the section of circuit board material, the processor being configured to move data between the first and second ports; and wherein the second port includes a backplane connector which is physically mounted to the section of circuit board material, the backplane connector being capable of mating with the backplane of the data storage system.

3. The network interface card of claim 2 wherein the control circuitry further includes memory which is physically mounted to the section of circuit board material, the memory being configured to buffer data moving between the first and second ports when the first port couples to the external network and the backplane connector mates with the backplane of the data storage system.

4. The network interface card of claim 1 wherein the second port includes:

(i) a set of data pathway conductors that forms, between the control circuitry and the processing circuitry, a portion of a data pathway to carry data for storage within the data storage system; and

(ii) a set of message pathway conductors that forms, between the control circuitry and the processing circuitry, a portion of a message pathway to carry messages for controlling storage of the data.

5. The network interface card of claim 4 wherein the set of data pathway conductors forms, between the control circuitry and the processing circuitry, a portion of a Fibre Channel bus.

6. The network interface card of claim 1 wherein the control circuitry is configured to exchange (i) Internet Protocol communications with the external network through the first port, and (ii) block-based communications with the processing circuitry of the data storage system through the second port and the backplane of the data storage system.

7. The network interface card of claim 6 wherein the control circuitry includes a map which maps filenames with blocks of a set of data storage devices of the data storage system, and wherein the control circuitry is further configured to receive a file-based Internet Protocol data access request from the external network and to access a block of data within the data storage system based on the file-based Internet Protocol data access request and the map.

8. The network interface card of claim 1 wherein the control circuitry is configured to operate as a processor of a multiprocessor system which simultaneously performs multiple application-level operations.

9. The network interface card of claim 8 wherein the control circuitry includes a hardware circuit that associates, with each application-level operation, a number that distinguishes that application-level operation among the multiple application-level operations simultaneously performed by the multiprocessor system.

10. In a data storage system having a backplane and processing circuitry for performing block-based data access operations, a method comprising the steps of:

coupling a first port of a network interface card to an external network;

physically connecting a second port of the network interface card to the backplane of the data storage system; and

configuring control circuitry of the network interface card to:

(i) receive file-based communications from the external network through the first port and provide block-based communications to the processing circuitry of the data storage system through the second port and the backplane in response to the file-based communications,

(ii) receive block-based communications from the processing circuitry through the second port and the backplane and provide file-based communications to the external network through the first port in response to the block-based communications, and

(iii) provide application server resources to operate as an application server that runs application-level programs.

11. The method of claim 10 wherein the control circuitry includes a section of circuit board material and a processor which is physically mounted to the section of circuit board material, the processor being configured to move data between the first and second ports; wherein the second port includes a backplane connector which is physically mounted to the section of circuit board material; and wherein the step of physically connecting the second port includes the step of mating the backplane connector with the backplane of the data storage system.

12. The method of claim 11, wherein the control circuitry further includes memory, and wherein the method further comprises the step of buffering data moving between the first and second ports.

13. The method of claim 10, wherein the second port includes (i) a set of data pathway conductors that forms, between the control circuitry and the processing circuitry, a portion of a data pathway to carry data between the control circuitry and the processing circuitry, and (ii) a set of message pathway conductors that forms, between the control circuitry and the processing circuitry, a portion of a message pathway to carry messages between the control circuitry and the processing circuitry, and wherein the method further comprises the steps of:

exchanging, between the control circuitry and the processing circuitry and through the portion of the data pathway, data for storage within the data storage system; and

exchanging, between the control circuitry and the processing circuitry and through the portion of the message pathway, messages for controlling storage of the data.

14. The method of claim 13 wherein the set of data pathway conductors forms, between the control circuitry and the processing circuitry, a portion of a Fibre Channel bus, and wherein the step of exchanging data between the control circuitry and the processing circuitry includes the step of:

passing the data through the portion of the Fibre Channel bus formed by the set of data pathway conductors.

15. The method of claim 10 wherein the step of receiving the file-based communications and providing the block-based communications includes the step of obtaining Internet Protocol communications from the external network through the first port; and wherein the step of receiving the block-based communications and providing the file-based communications includes the step of sending Internet Protocol communications to the external network through the first port.

16. The method of claim 15 wherein the control circuitry includes a map which maps filenames with blocks of a set of data storage devices of the data storage system; and wherein the step of receiving the file-based communications and providing the block-based communications further includes the step of:

accessing a block of data within the data storage system based on a file-based Internet Protocol data access request obtained from the external network through the first port and the map.

17. The method of claim 10 wherein the step of configuring the control circuitry further includes the step of:

setting up the control circuitry to operate as a processor of a multiprocessor system which simultaneously performs multiple application-level operations.

18. The method of claim 17 wherein the control circuitry includes a hardware circuit, and wherein the step of setting up the control circuitry includes the step of:

activating the hardware circuit to associate, with each application-level operation, a number that distinguishes that application-level operation among the multiple application-level operations simultaneously performed by the multiprocessor system.

19. A data storage system, comprising:

a backplane;

processing circuitry that is physically connected to the backplane, the processing circuitry being configured to perform block-based data access operations; and

a network interface card having a first port that is capable of coupling to an external network, a second port that is physically connected to the backplane, and control circuitry interconnected between the first port and the second port, the control circuitry being configured to:

(i) receive file-based communications from the external network through the first port and provide block-based communications to the processing circuitry through the second port and the backplane in response to the file-based communications,

(ii) receive block-based communications from the processing circuitry through the second port and the backplane and provide file-based communications to the external network through the first port in response to the block-based communications, and

(iii) provide application server resources to operate as an application server that runs application-level programs.

20. The data storage system of claim 19, further comprising:

another network interface card having a third port that is capable of coupling to the external network, a fourth port that is physically connected to the backplane, and control circuitry interconnected between the third port and the fourth port, the control circuitry of the other network interface card being configured to:

(i) receive other file-based communications from the external network through the third port and provide block-based communications to the processing circuitry through the fourth port and the backplane in response to the other file-based communications,

(ii) receive other block-based communications from the processing circuitry through the fourth port and the backplane and provide file-based communications to the external network through the third port in response to the other block-based communications, and

(iii) provide other application server resources to operate as another application server that runs application-level programs in a multiprocessing manner.